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No. 61

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University of California, Berkeley, California, U.S.A. (91)

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AERONAUTICAL KNOWLEDGE

AUTHOR: LI Cuying [2621 2945 5235]

ORG: None

TITLE: "Test Flight Heroes"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 2-3

ABSTRACT: On January 3 of this year, the Central Committee of Military Affairs issued the citations of "Scientific Test Flight Hero" to two test pilots: Hua jun (3323 0193) and Wang ang (3769 2491). Hua jun is a 20-year veteran test pilot with little formal education; he had test-flown many Chinese made fighter airplanes. Wang ang, who is a graduate of the Beijing Aeronautical Institute, has been a test pilot since 1966; he had successfully completed 95 test flight missions for the purpose of scientific research. The photographs of these two test flight heroes are shown on the front cover of this issue and a selected number of their contributions to the scientific community are reported in this article.

AUTHOR: LIU Mouji [0491 6180 0165]

ORG: None

TITLE: "Wing Tip Ailerons"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 14-16

ABSTRACT: Wing tip ailerons are small vertical airfoils installed at the tips of a conventional wing. They are designed to generate thrust forces by taking advantage of the induced cross flows over the upper and lower surfaces of the wing. They can also be installed at an inclined position to generate lift forces and thus increase the lift to drag ratio of the airplane. In addition, they serve the function of weakening the trailing vortices of a large airplane which may otherwise endanger a small airplane flying in its wake. Currently, NASA is continuing its research effort to study the problems of added moment, weight, and vibration associated with wing tip ailerons.

AUTHOR: YEN Liliang [251P 4350 1016]

ORG: None

TITLE: "Critical Rotational Speed"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 20-21

ABSTRACT: The phenomenon of "critical rotational speed" of a rotor is the resonant vibration of the rotor which occurs when the frequency of a periodically varying external force approaches the characteristic frequency of the rotor. In this article, the author describes an experiment in which the phenomenon of critical rotational speed due to unbalanced centrifugal forces acting on the rotor is demonstrated. The experiment also illustrates the phenomenon of "center of gravity reversal" which explains why rotor vibration diminishes when the rotational speed exceeds the critical speed. In conclusion, the author suggests several rotor designs which will avoid the damaging effects caused by critical rotational speed.

AUTHOR: LIAO Xienwang [1675 0341 2489]

ORG: None

TITLE: "Particle Beam Weapon"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 26-28

ABSTRACT: Particle beam weapon is a new weapon system which uses particle accelerator in strategic defense and space warfare. The basic components of a particle beam weapon include: the search, discrimination, and tracking subsystem, the particle accelerator subsystem, and the particle beam aiming and tracking subsystem. Because of its potential military value, both the United States and the Soviet Union are actively engaged in the research and development of this new weapon system. In this article, the basic operation of a self-resonant accelerator is explained. The power requirement, the propagation effects, and the destructive capability of a particle beam weapon are also discussed. In conclusion, the technological difficulties and cost considerations in developing a practical particle beam weapon system are reviewed.

AUTHOR: CHEN Bincal [7115 3453 2088]

ORG: None

TITLE: "Evolution of Laser Guided Bombs"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 32-34

ABSTRACT: During the early 1960's, the United States Army began research and development on laser guidance technology. In 1965, the North American Aviation Company and the Texas Instrument Company both submitted proposals to the Air Force to build laser guided bombs and began prototype designs. During the second half of 1966, both companies engaged in competitive tests to demonstrate the feasibility of their designs. The winner of the competition was the Texas Instrument prototype design, which used an aerodynamically stabilized warhead. Since May 1967, a series of tests were conducted at the Eglin Air Force Base and several technical improvements were made to the original design. In 1968, the laser guided bomb was first used in actual battles during the Southeast Asian war.

AUTHOR: None

ORG: None

TITLE: "Application of Miniature Electric Motors on Space Vehicles"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 3 Mar 80 pp 34-35

ABSTRACT: Miniature electric motors are the key components of many devices on space vehicles to perform such functions as automatic control, automatic regulation, automatic measurement, and automatic inspection, etc. Typical applications of miniature motors on space vehicles include gyroscopes, magnetic tape recorders, spin stabilizers, moment control gyroscopes, gimbal torquing devices, gyroscope torquing devices, and scanning earth sensors.

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CSO: 4009



AERONAUTICAL KNOWLEDGE

AUTHOR: HAN Shijie [7281 0013 2638]

ORG: None

TITLE: "Laser Gyroscope"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 9, Sep 80 pp 16-17

ABSTRACT: Laser gyroscope is an instrument which uses optical principles to measure the angular velocity of a rotating body. Compared with conventional gyroscopes, it has several advantages such as high reliability, short starting time, and high stability. In this article, the structure of a triangular laser gyroscope is described and the basic principle of using laser to measure angular velocity is explained. The so-called "locking phenomenon" at low angular velocity and methods of overcoming this difficulty are introduced. In conclusion, the applications of laser gyroscope for the inertial guidance of tactical missiles, airplanes, and space vehicles are briefly discussed.

AUTHOR: LO Junjie [5012 0193 2638]

ORG: None

TITLE: "Short Range Attack Missile"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 9, Sep 80 pp 18-20

ABSTRACT: The short range attack missile (SRAM) was developed by the United States in the 60's to support long range bombers to penetrate Soviet defense systems armed with SA-2 and SA-3 surface-to-air missiles. In this article, the basic components of an SRAM which include the body structure, the trigger fusing device, the reserve storage compartment, the warhead, the electronic module, the engine, and the flight control system are described. The deployment procedure of SRAM from a B-52, FB-111, or B-1 bomber and its trajectory characteristics are also illustrated. In particular, the special guidance technique called the "imagined target pursuit technique" used by the SRAM is discussed. In conclusion, current plans for further developing and improving the SRAM are summarized.



AUTHOR: HSU Dekang [1776 1795 1660]

ORG: None

TITLE: "New Drag Reduction Techniques"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 9, Sep 80 pp 24-26

ABSTRACT: In dialogue form, the author discusses several new techniques that may be used to reduce aerodynamic drag: 1) the use of seal skin-like surface materials to maintain laminar boundary layer flow and thus reduce friction; 2) boundary layer control by blowing low speed air stream over the wing surface to reduce frictional drag; 3) the reduction of turbulent flow instability in the boundary layer by mixing minute particles, high molecules, or hydrogen bubbles in the air stream; 4) the use of a thin plastic cover over the wing surface to eliminate surface roughness and reduce total drag.

AUTHOR: HO Yaxi [6320 0068 0363]

ORG: None

TITLE: "Protecting the Airplane's Eyes"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 9, Sep 80 pp 33-34

ABSTRACT: This article discusses the various measures of protecting the radome located at the nose of an airplane. The radome contains the radar antenna which serves the function of airplane's "eyes". Specifically, the following protective measures are discussed: 1) coating of radome surface with polyurethane or other polyester materials to prevent rain corrosion; 2) coating the radome with conducting materials to prevent accumulation of static electricity; and 3) installation of metallic strips over the radome to avoid damages by lightening.

AUTHOR: FENG Xiencheng [7458 3759 2052]

ORG: None

TITLE: "Aerial Electronic Surveillance"

SOURCE: Beijing HANGKONG ZHISHI [AERONAUTICAL KNOWLEDGE] in Chinese No 9, Sep 80 pp 34-35

ABSTRACT: Aerial electronic surveillance systems are primarily used to detect and measure the important parameters of enemy radars from a vantage point in the air. In this article, the operating principle of receivers for radar surveillance is explained. Typical applications of aerial electronic surveillance systems are discussed. They include: 1) threat warning surveillance receivers used on military airplanes for self defense; 2) direction finding and position fixing systems used to guide offensive weapons; 3) surveillance receivers used to direct electronic interference and jamming signals; and 4) electronic surveillance satellites designed to intercept signals emitted from enemy electronic facilities.

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CSO: 4009

AUTHOR: DING Shuxiu [0002 2885 0208]  
 CUI Xueling [1508 1331 3781]  
 FU Shoudi [0102 1343 1229]

ORG: None

TITLE: "Experimental Research on High Temperature Oil Well Cement"

SOURCE: Beijing SHINI [CEMENT] in Chinese No 1, Feb 80 pp 1-6, 36

ABSTRACT: When oil, gas wells and geothermal wells of especially high ground temperature gradient in depth of 5000-7000m are drilled, the temperature of the bottom of the well is about 150-200°C. To stabilize a well under such a high temperature condition, it is necessary to use adhesive material of a special technical property, otherwise the strength will deteriorate and permeability increase. In foreign countries, a cement-sand mixture, a slag-sand mixture, or a red mud-sand mixture, and  $\beta$ -C<sub>2</sub>S and quartz sand are used as the base to proceed with hydrothermal reaction for one of the 3 materials to produce the high strength and heat resistant stability needed for these wells. The authors studied the above 3 systems of adhesive materials separately. The paper discusses the method and ratio of mixing high temperature oil well cement and its work parameters, the physical and mechanical properties under the condition of high temperature hydrothermal condition, the effects of retardants, and hydrothermal reactions and phase compositions of the hydroxides under the condition of high temperature and high pressure.

AUTHOR: None

ORG: Changzhou Cement Plant

TITLE: "Comprehensive Utilization of 3 Wastes of Cement Rotary Kiln"

SOURCE: Beijing SHINI [CEMENT] in Chinese No 1, Feb 80 pp 7-9

ABSTRACT: Changzhou Cement Plant was established in 1958, with 2 common, small standing kilns and a designed capacity of 32,000,000 tons of No 400 cement per year. It was expanded in 1974 to add a small rotary kiln of the size of 2.4 x 2.2 x 39.3 m. The Institute of Cement Research of the Academy of Construction Materials joined the plant to take on the responsibility of a production intermediate experiment of using high potassium materials to produce cement as well as potassium fertilizer. After 4 years of experimentation and practice, the products have basically reached the indices specified by the State, and a technology certification was granted by the General Bureau of State's Construction Material Industries and the Ministry of Chemical Industry. This paper introduces the work procedure, the major equipment, the capital investment and required materials, and the economical benefits of the technique for utilization of 3 wastes of the cement rotary kiln. Problems in the production process are also discussed.

AUTHOR: GE Baojun [5514 0802 0193]

ORG: Nanping Cement Plant

TITLE: "Introducing the Experience of Using Gangue to Burn Dryer Boiler"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 1, Feb 80 pp 9-10

ABSTRACT: Toward the end of 1977, the author and colleagues succeeded in using gangue in the dryer boiler. Production of the plant's  $\phi 1.5 \times 12$  m rotary dryer boiler has been normal for these 2 years. The chemical composition of the gangue of Shaowu Anthracite Mine and the Huainan Bituminous Coal Mine is given. Specifications of the rotary dryer boiler are described. The use of gangue to replace coal has produced a saving of 3,000 tons of anthracite and bituminous coal at the plant. After burning at 900°C, the slag of 70-80 percent of the gangue used contains 3 percent of carbon and more than 80 percent of silicon dioxide and aluminum trioxide, which are good cement mixture materials. The gangue slag was found in experiments to be of similar quality as that of volcanic ash for making cement. All in all, the use of gangue has realized a saving of about 100,000 yuan per year for the plant.

AUTHOR: ZHU Dalong [2612 1129 7893]

ORG: Institute of Cement Research, Academy of Construction Materials

TITLE: "Experiment With Burning Inferior Coal in Decomposition Furnace"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 1, Feb 80 pp 11-14

ABSTRACT: With the development of the new technique of decomposing cement outside the kiln, studies on using oil or coal in the decomposition furnace have both succeeded. A work process was designed to test the feasibility of using inferior coal or gangue in small decomposition furnaces. This paper reports the experiments and discusses the problems of the amount of heat produced and the structure and uniformity of the cooked material. The paper concludes that under current experimental condition, the bituminous gangue of Jingxi Coal Mine and Kailuan Coal Mine cannot be burned in the decomposition furnace, but when bituminous coal is used as a starter or to form a mixture to release about 2000 C/kg of heat, then burning is possible although slow. If volatility of mixture reaches 15 percent to release 2400-2500 C/kg of heat, the mixture can burn easily and fast. The composition of inferior coals from various regions varies a great deal; therefore, it may be said that about 40-70 percent of the fuel of the decomposition furnace may be inferior coal.

AUTHOR: ZHENG Kunyuan [6774 6934 3293]

ORG: None

TITLE: "On Several Problems of Vertical Kiln Production"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 1, Feb 80 pp 44-47

ABSTRACT: At present, the production of vertical kilns in the more than 3,000 cement plants of varying sizes has been greatly improved, but there remain a few shortcomings, such as unstable burning, uneven quality of products, low productivity, etc. This paper discusses mainly problems of quality of the clinker produced by the vertical kilns. Problems include failure to control the quality of raw materials, in the various stages of mining, transportation and storage, the quality of the limestone is often less than standard. The percentage composition of various raw materials in the mixture is often less than stable. For improvement, a composition of 0.87-0.92 KH, 2.0-2.3 of n and 1.3-1.8 of P is suggested. The major portion of the paper contains suggestions for improving the vertical kilns and the work procedure. The method, suggested in a foreign country, of adding a small amount of soluble salt to reduce the melting point of the nodules locally as the salt is shifted to the surface in the drying process to overcome the problem of uneven burning in the vertical kiln is also recommended.

AUTHOR: None

ORG: Harbin City Songhuajiang Cement Plant

TITLE: "Improving the Quality of Vertical Kiln Clinker by Mixing Aluminite in the Raw Material"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 1, Feb 80 pp 48-49, 65

ABSTRACT: The design capacity of Songhuajiang Cement Plant is 32,000 tons per year and for a long time, the production stayed at about 40,000 tons, with the quality of the cement varying a great deal. Especially in the 6 months long winter, the quality had been very difficult to guarantee. Basically 2 factors affect the quality of clinker of the vertical kilns: (1) The chemical composition and physical state of the raw material; (2) The duration and condition of the material in the various temperature zones in the kiln and especially the temperature of the high temperature zone and the speed of cooling. In terms of the raw material, the quality of the limestone was not stable, the sand content of the clay was too high, and the aluminum content of the raw material was too low. Beginning in Sep 78, a method was adopted to raise the  $Al_2O_3$  content to increase the formation of  $C_3S$  and reduce  $fCaO$  by adding 5 percent aluminite (amounting to about 30 percent of the clay). Since then, the quality of the cement has been obviously improved. The quality did not drop during the severe winter months, and a batch of No 600 cement was produced in the frigid weather.



AUTHOR: LI Guoqi [2621 0948 4388]  
LIANG Chaoqun [2733 6389 5028]

ORG: Both of Tangshan 422 Cement Plant

TITLE: "Proposed Reconstruction of Dry Method Rotary Kiln With Residual Heat Furnace"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 1-4

ABSTRACT: In China, about 80 percent of the dry method rotary kilns have residual heat furnace. Tangshan 422 Cement Plant originally has 6 dry method rotary kilns of different specifications with 5 residual heat furnaces; the capacities of the two are not coordinated. The exhaust of 2 kilns enters one residual heat furnace to cause poor ventilation. Another furnace has insufficient drawing capacity to cause it necessary to exhaust portion of the waste gas of 2 kilns through the chimney. For reconstruction, the authors suggest the 2 basic principles of (1) Using the new technique of suspension decomposition preheating to expand the productivity of the kilns; (2) In the second stage, when the electrical power supply is sufficiently enlarged, the power generating system of the residual heat furnace may be eliminated and the kiln exhaust be directed to the decomposition furnace and the raw material preheating system to form a standard decomposition furnace outside the kiln. Problems related to the proposed 2-stage reconstruction plan are discussed.

AUTHOR: LIU Shuzu [0491 6615 4371]

ORG: None

TITLE: "On the Technological Characteristics of Extra-kiln Decomposition Furnace"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 5-7

ABSTRACT: In the SF kiln system adopted in Japan, the exhaust of the rotary kiln is mixed with air 3 times before entering the decomposition furnace to be used for burning as well as heat exchange medium before further entering the preheater system. The design of China's first horizontal oil-fueled decomposition furnace has a different flow process. The decomposition temperature is generally at 900°C. If the temperature of the kiln exhaust is above 1000°C, it is useful for the furnace. But, as the temperature of the exhaust is 880-930°C, it does not supply the furnace with heat energy. Two changes are proposed in the paper: (1) If the temperature of the exhaust is low, the flow process should be changed; (2) The flow process may remain as designed, but the gas temperature of the kiln should be raised and measures should be taken to prevent obstruction.

AUTHOR: SHEN Guoxing [3088 0948 5281]

ORG: None

TITLE: "On High Position Placement of the Material Slurry Pump"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 8-15

ABSTRACT: In China's wet production cement plants, the material slurry and the clay slurry are both delivered by pumps. A single suction suspended arm centrifuge pump is used for material slurry and is installed lower than the surface of fluid to be sucked for inverse feed. The shortcoming of this characteristic is the fact that the upward suction capability of the pump is not used. In many power generating plants in China, the ash and slag pump is placed higher to produce a very satisfactory operation. This paper defines some terms used in pump technology to clarify certain confusion related to the desired position of the pump, and provides various calculations to demonstrate the merits of the high position placement of the pump.

AUTHOR: PANG Lixiang [1690 4539 3276]

LIU Zhilan [0491 1807 5695]

SUI Qinxiang [7131 3830 7449]

ORG: All of Institute of Cement Research, Academy of Construction Materials

TITLE: "Fast Volume Analysis of Cement Raw Material"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 23-29

ABSTRACT: The authors changed the work procedure by using a silver crucible instead of the platinum dish. A high alkaline solution is used to dissolve the specimen before adding a high density acid to produce a transparent solution. Various amounts of the solution are used to determine the silicon dioxide, ferric oxide, aluminum trioxide and titanium dioxide, calcium oxide, and magnesium oxide contents. Methods of chemical analyses of clayey and the iron ore material are explained in separate chapters.



**AUTHOR:** WANG Shaokun [3769 4801 0981]

**ORG:** Xiaoshan Cement Plant

**TITLE:** "Charts for Approximate Calculation of the New Standard Cement Clinker Average Grading"

**SOURCE:** Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 30-31

**ABSTRACT:** Based upon the method of calculating the average grade of cement clinker announced by the Ministry of Construction Materials, this paper presents 2 charts for quick reading of the grade of the clinker based upon the 3-day, 7-day, and 28-day tensile and compressive strength data respectively.

**AUTHOR:** SHI Zongcan [2457 1350 3503]

**ORG:** Nanyang District Cement Plant

**TITLE:** "Simplified Method of Calculating the Result of Cement Production Control Analysis"

**SOURCE:** Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 32-33

**ABSTRACT:** In production control analyses, the various standard solutions such as the potassium perchromate for determining ferric oxide, etc. are mixed according to the densities given in reference books and equations or charts must be used after results are obtained from the analyses. This process is time consuming and error of computation occurs easily. This paper introduces a new density for preparing the various solutions. The computation program may thus be eliminated. The titer milliliter value is the percentage content desired.

AUTHOR: WANG Xianke [3769 3759 4430]

ORG: Comprehensive Machine Shop, Lanzhou Steel Mill

TITLE: "Iodine Phosphate Volume Method of Determining  $\text{Fe}_2\text{O}_3$  in Cement Raw Material"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 33-34

ABSTRACT: The theory of the method introduced in the paper is to dissolve the specimen with phosphoric acid before adding hydrochloric acid to break down the complex compound produced from phosphoric acid and iron to convert the iron into an oxide. KI is added to reduce  $\text{Fe}^{3+}$  to  $\text{Fe}^{2+}$  and separate out  $\text{I}_2$ . Using amylolytic powder as the indicator and  $\text{Na}_2\text{S}_2\text{O}_3$  to separate out iodine. The reagents used and the test procedure are explained.

AUTHOR: None

ORG: Department of Technical Inspection, Guiyang Cement Plant

TITLE: "Opinions Concerning Improving the Method of Determining  $\text{SO}_3$  in Fluor Aluminate Cement"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 p 35

ABSTRACT: In various degrees, fluor phosphides are introduced into the raw materials of several types of fast setting cement produced by the Guiyang Cement Plant; therefore, strong acid positive ion exchange method can no longer produce correct result of the  $\text{SO}_3$  content. The  $\text{BaSO}_4$  method may produce accurate results, but it is too time consuming. The paper suggests some improvements to the original  $\text{C}_{12}\text{H}_{12}\text{N}_2\text{HCl}$  volume method of determining  $\text{SO}_3$  by (1) Use boiling water and large quantity of positive ion exchange resin to stir  $\text{NH}_4\text{Cl}$  for 10 minutes; (2) "Use  $\text{C}_{12}\text{H}_{12}\text{N}_2\text{HCl}$  filter fluid to wash the precipitate twice before washing with cold water" should be changed to washing with cold water 2-3 times; (3) Instead of measuring a given quantity of water and boiling it, water should be boiled first before measuring 100-150 ml. The theory of the suggested improvements and the method of analysis are explained.

AUTHOR: LI Zhikun [2621 3112 0981]

ORG: Chemical Testing Laboratory, Guangxi Metallurgy Construction Company

TITLE: "Using Chemical Method For Fast Determination of Cement Grade"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 36-37

ABSTRACT: Strength is one of the major quality indices of cement. If the standard method is used to test strength, 28 days are needed to grade the cement. Beginning in 1964, the company has studied the use of chemical method to determine the grade of the cement. A series of tests were conducted and measures to eliminate the influence of various factors were proposed, to produce finally a method of using 0.05N hydrochloric acid standard solvent, 0.1 g of sodium anhydrous carbonate, and 1-2 drops of methyl red. The theory of the chemical method to derive the compressive strength of cement in 3.5 hours instead of 28 days is described, as well as the reagents and work procedure.

AUTHOR: None

ORG: Physics Laboratory, Institute of Cement Research, Academy of Construction Materials

TITLE: "Electric Powered Stretch (Break) Resistance Machine"

SOURCE: Beijing SMUINI [CEMENT] in Chinese No 2, Apr 80 pp 38-29, 34

ABSTRACT: In China, the old lever style machine for testing tensile and break resistance of cement requires the worker to lift a bucket of lead pellets and is, therefore, very labor intensive and inconvenient. A new machine was designed using fixed weights moving on a level to determine the load. The work theories and the test results of the old and the new machines are compared. The structure of the new machine and its work procedure are described and illustrated with drawings.

AUTHOR: LIU Yuqi [0491 3768 3825]

UNIT: Jinan Cement Plant

TITLE: "Device for Automatic Control of Mesh of Wet Sieve"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 40-42

ABSTRACT: Wet sieve is a creation in China for sieve analysis; it is more accurate, faster, and less labor intensive than the dry sieve technique and has now been extensively adopted by cement plants all over the country. In new regulated cement standards, wet sieve method is also listed as one way of inspecting the fineness of cement. The current wet sieve process has many required test conditions and depends entirely upon workers to manage and control the various stages. The work procedure is complex and certain error is difficult to avoid. The Jinan Cement Plant installed an automatic device to control the mesh and stabilize the test conditions. The sequence of movements of the electronic components in the automatic control device is described. A water tank is used to stabilize the water pressure, electromagnetic valve and mercury switch are used to control the water table [level], a relay and electromagnetic valve are used to control the analysis time, a motor gearshift and a relay are coordinated to control the rotation of the sieve. The work procedure of the control device is explained.

AUTHOR: QI Wenkun [7871 2429 0981]

UNIT: Songhuajiang Cement Plant

TITLE: "Cement Automatic Sample Taking Device"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 2, Apr 80 pp 42-43

ABSTRACT: Most recently a cement sample taking device was designed and installed at Songhuajiang Cement Plant at the material input funnel of the machine that lifts the cement in the packing machine shop. In the past, two physical chemical technicians were required to use a "tester" to fetch a sample from every bag of cement. The two must work more than one hour to obtain samples from every one hundred tons of cement. With the new sample-taking device, the analysis technician just go to the machine shop once a day to fetch the samples taken by the automatic device. The device may be set for the desired interval and quantity of sample taking. The structure of the automatic sample-taking device is described and illustrated.

AUTHOR: SUN Shuyun [137 2579 3893]

ORG: Tianjin Municipal Cement Plant

TITLE: "Production of  $\Phi$  3.6 x 10 m Short and Large Tower Style Standing Kiln"

SOURCE: Beijing SHINI [CEMENT] in Chinese No 2, Apr 80 pp 44-50

ABSTRACT: This paper reports the design production condition of the  $\Phi$  3.6 x 10m standing kiln. The production practice using that kiln at the Tianjin Municipal Cement Plant has proved that the kiln has the merits of high quality cement and economical production. It is estimated that the successful design of this kiln will contribute substantially to the technical reform and production development of China's small cement industries. The design and the production parameters and capacity of the kiln are described at length.

AUTHOR: ZHONG Wei [6945 7614]

ORG: Gannan Cement Plant

TITLE: "Photoelectric Cement Package Counter"

SOURCE: Beijing SHINI [CEMENT] in Chinese No 2, Apr 80 p 50

ABSTRACT: Ordinarily, after cement is packed in packages at a cement plant, they are moved on a conveyor belt, while a worker or workers must count the packages on the belt manually. The author and colleagues designed and installed an automatic counter. A light source A is installed on one side of the conveyor belt and a photosensitive diode A' is installed on the opposite side. When a package of cement is moved passing the AA' line, a photo pulse is generated. It is changed into an electrical pulse by the internal electronic circuit of the counter, which records and displays the pulses. A number is constantly displayed to show how many packages has passed the line as long as the conveyor is in operation and the light source is turned on. The machine is simple and reliable, but the electronic circuit remains too complex to cause the cost of the counter to be too high.

AUTHOR: Yu Chen [0131 6591]

ORG: None

TITLE: "Suggestions Concerning Work Adjustment of Rotary Kiln Production"

SOURCE: Beijing SHUN [CEMENT] in Chinese No 3, Jun 80 pp 1-8

ABSTRACT: Under the condition of identical kiln diameter and production conditions, compared with kilns in foreign countries, Chinese rotary kilns are 15 percent lower in heat generating capacity of wet method kilns and 17 percent lower with standing wave kilns, and 6.2-16.3 percent lower in cross-section negative load wet method kilns. The kiln gasket has 4 times shorter useful life than foreign kilns, however. These data indicate that not only the level of technology is low in China, the quality of the materials is still inferior. The quality of the clinker produced in China is below the British Standard, the heat consumption is higher, and the dust dispersion is 3-5 percent greater. This paper analyzes the difference and the reasons causing the difference as well as proposes changes of the work process to improve rotary kiln production in China for the purpose of catching up with rotary kiln production records of foreign countries.

AUTHOR: Li Jiansen [2621 1696 2773]

ORG: Tangshan Design Institute, First Cement Industry Academy of Design

TITLE: "Investigation Into the Method of Computing Wheel Belt of Rotary Kiln"

SOURCE: Beijing SHUN [CEMENT] in Chinese No 3, Jun 80 pp 8-15

ABSTRACT: Horizontal deformation of the cylinder of the rotary kiln affects the life of the kiln lining and the rotation rate of the kiln. This contradiction becomes more noticeable as the size of the kiln grows larger. For reasons of manufacturing, material supply, transportation, and economy, the thickness of the cylinder cannot be increased to reduce the rate of deformation. Practices and theoretical studies have proved that the structure, method of installation, and assembly of the wheel belt have significant effect on cylinder deformation, especially, the wheel belt must have a sufficient strength. The design calculation of the strength and durability of the wheel belt has, therefore, become one of the key problems in design, maintenance, and trouble analysis of rotary kilns. Considerations in designing wheel belt of rotary kilns are discussed in considerable detail in the paper.



AUTHOR: DAI Shunsheng [7071 1471 3935]

ORG: Tongji University

TITLE: "Power Computation of the Nodule-forming Plate"

SOURCE: Beijing SHUNJI [CEMENT] in Chinese No 3, Jun 80 pp 15-18

ABSTRACT: Nodule formation is an important work procedure in vertical kiln and standing wave kiln cement production. The quality and quantity of nodule production have direct effect on the productivity of the kiln, quality of the clinker, and such economic indices as heat and electricity consumption, etc. Although there have been many studies on the work parameters of the nodule-formation plate, the author and colleagues have discovered in practice that the power computation equations of the nodule-formation plate remains theoretically less than perfect. Results of computation are very different from actual measurement data. This paper analyzes the existing equations and suggests changes.

AUTHOR: WU Zhaozheng [0702 0340 2973]  
CHENG Xibi [2052 1585 1732]  
HUANG Wenduan [7806 2429 4551]  
LUO Shuxian [7482 3219 1288]  
LIU Guiyu [0491 5050 3768]  
LIN Chunyun [2651 2504 3768]

ORG: None

TITLE: "Experimental Research on Improving Early Stage Strength of Slag Cement"

SOURCE: Beijing SHUNJI [CEMENT] in Chinese No 3, Jun 80 pp 19-24, 36

ABSTRACT: China's annual production of slag silicate cement is more than 20,000,000 tons, by 30 large and medium plants and most of the small plants. The quantity is the highest among China's cement products. In property, the long term strength is high and water resistance is good, but the early stage strength is less than ideal. A 5-point program of (1) improving the quality of clinker; (2) grinding it reasonably fine; (3) selecting the slag mixture; (4) increasing the gypsum quantity; (5) mix in other additives was carried out in Huaxin Cement Plant under the condition of not adding manpower and equipment and not affecting existing production. Detail data of the study program are reported.



AUTHOR: None

ORG: Physical Laboratory, Academy of Construction Materials

TITLE: "A Discussion of the Method of Testing Pulverized Coal Ash Activity"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Apr 80 pp 25-30

ABSTRACT: Pulverized coal ash is the industrial residue of coal burning electrical power generators. At present, following the development of electrical power, China's yearly production of such ash is more than 30,000,000 tons, while only 2,900,000 tons of this ash a year is utilized. Most of the ash, more than 90 percent of it is flushed out to allow it to occupy cropland, obstruct streams and rivers, and pollute the environment. It is in fact a very good active cement mixing material. Considering the fact that this ash is not entirely the same as volcanic ash and the fact that its dry shrinkage is less, and its break resistance is better, it has now been listed in China's new regulation on cement; a new standard for pulverized coal ash is needed. This paper compares the activity indices for such ash in the USA, USSR, Japan, Bulgaria, and China and reports an experiment using rotary kiln clinker of 7 plants to test the results of chemical analyses and ISO test of the activity of the pulverized coal ash.

AUTHOR: WANG Wenyi [3769 2429 0034]  
ZHANG Datong [1728 1129 0681]

ORG: None

TITLE: "Analysis of Factors Affecting Softness and Hardness of Cement"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 30-36

ABSTRACT: China's new standard for cement has been officially in force since 1 Jan this year. One of the important element of the new standard is that the hard test for strength is changed to soft test. Due to the fact that the soft test cannot correctly reflect the action of the cement in plastic concrete, some grades are no longer factual. In mixing concrete, ordinary cement and slag cement of the same grade do not produce the same result. This paper discusses the major factors, including KH, CaO content, silicate ratio, aluminum content,  $K_2O$ ,  $Na_2O$  contents, etc. on the strength of the cement, based upon test data of many large and medium cement plants in China.

AUTHOR: CHEN Xiaoqing [7115 2556 7230]  
LIU Shoushan [0491 1943 6365]

ORG: CHEN of Xi'an Municipal Cement Plant; LIU of Shaanxi Xinchuan Cement Plant

TITLE: "Rejustment Tuning of Frequency Sensitive Variable Resistor"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 37-41

ABSTRACT: Frequency sensitive variable resistor is an electrical instrument designed and produced in China. It is used to start coil type induction motors. It has a simple structure, is long lasting, and convenient to repair, but it is not a linear component. As the impedance of motors is different, it is difficult to compute the timing accurately. Cases of burned motors and short circuit are not rare when the frequency sensitive variable resistor is not correctly adjusted. This paper reports a technique of converting the resistor to eliminate its shortcomings. Several samples are given to illustrate the needed adjustment in accordance with the parameters of the motor.

AUTHOR: YU Jiunan [0151 1432 0589]

ORG: Shande Cement Plant

TITLE: "Several Technical Measures to Improve the Quality and Quantity of Production of Tower Style Vertical Kilns"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 42-46, 48

ABSTRACT: The Shande Cement Plant has a vertical kiln of  $\phi 2.5 \times 10$  m. The inside ventilation is relatively even to provide a favorable condition for enlarging the diameter of the kiln. This paper reports the methods of enlarging the diameter of the kiln, increasing the air in the middle of the kiln, reconstructing some mechanical parts, and redesigning the work procedure to improve the productivity and the quality of products of the kiln.

**AUTHOR:** None

**ORG:** Huaxin Cement Plant

**TITLE:** "Condition of Use of High Voltage Static Electricity Dust Remover Installed at Turning Point of the Slag Delivery Conveyor Belt"

**SOURCE:** Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 47-48

**ABSTRACT:** This paper reports a simple dust remover. It is composed of the 3 parts of a special transformer silicon rectifier, and control device, and a sealed belt cover. Its dust removal efficiency is above 90 percent. The structure of the device is described. Diagrams are given to illustrate the manual control device and the assembly of the various components.

**AUTHOR:** JIN Xing [6855 2502]

**ORG:** Shanghai Cement Plant

**TITLE:** "Pulse Forced Air Delivery"

**SOURCE:** Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 49-50

**ABSTRACT:** In foreign countries, pulse forced air delivery is used to transport many articles, including drugs, grain, cement, sugar, etc. It is especially suitable for transporting granular or powdered materials of less than 8 mm in diameter. It can transport several to several tens of tons to a distance as far as 1000 m. In China, this type of device is used for transporting flour, sand used to make cast molds, etc. The Shanghai Cement Plant installed such a device in connection with its slag dryer in its Second Plant toward the end of 1978. Very good result has been obtained. This paper introduces the theory of this device and the work procedure in the Second Plant. A drawing depicting the work process of the entire machine is included.

AUTHOR: TONG Maizhou [0157 3189 1558]  
QIAN Ruchong [6828 3067 0022]

ORG: TONG of Yongdeng Cement Plant; QIAN of Sichuan Institute of Cement Research

TITLE: "Pre-breaking Technique for Wet Method Raw Material Grinding"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 51-55

ABSTRACT: For the purpose of improving the grinding quality and reducing power consumption, Yongdeng Cement Plant added a hammer type machine to break the limestone in 3 stages before the raw material of the wet method is ground, to make the grains of the limestone smaller. After the adoption of the pre-breaking procedure in 1963, the productivity of the mill was raised 40 percent while the power consumption was reduced 25 percent. Effects of the pre-breaking process on the size of the grain of the material entering the mill are studied. The pre-breaking process is described.

AUTHOR: ZENG Deqian [2582 1795 0356]

ORG: Guangzhou Municipal Chatou Cement Plant

TITLE: "Proposed Design of a Vertical Kiln With Top Spray Blowing"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 55-57

ABSTRACT: Practice proved that the major factor limiting further enlargement of the diameter of the vertical kiln is the poor boundary wind resistance to cause the ventilation on the horizontal cross-section to be uneven. For a long time, with respect to reconstructing the vertical kiln, considerations have usually been given to the burning medium, the chemical composition of the nodular material, and its physical property. Very little thoughts have been given to improving the poor ventilation condition of the middle of the kiln. This paper is an attempt to analyze the reason for the imbalance of ventilation between the center and the edge, and proposes a method of spray blowing from the top of the kiln. Drawings are given to explain the author's analysis of the situation and his proposed solution.

AUTHOR: FU Qingfu [0265 1987 1788]

ORG: Shandong Boshan Cement Plant

TITLE: "Understanding in Using Vertical Kiln to Produce Ordinary No 500 Cement Entirely"

SOURCE: Beijing SHUINI [CEMENT] in Chinese No 3, Jun 80 pp 58-60

ABSTRACT: Measures were adopted by Shandong Boshan Cement Plant to reconstruct its work procedure to improve the quality of its products. The major techniques include using the  $\phi 2.5 \times 10$  m tower style and  $\phi 2.6 \times$  a disk style vertical kilns to produce from black raw material only, increasing the saturation ratio, and reducing the free lime content. As a result, in 4 months of continuous production, its ordinary No 500 cement products have had a qualifying rate of 100 percent. The concrete measures adopted are described.

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## Metallurgy

AUTHOR: Qi Likuan [2058 4539 1401]  
LUO Yuchang [5012 3768 7022]  
YANG Siming [2799 1835 2494]

ORG: All of Shandong Aluminum Plant

TITLE: "The Removal of Sulfur Compounds in Soda-Lime Sintering Process for Production of Alumina"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 299-304

TEXT OF ENGLISH ABSTRACT: Sodium sulfate is formed from pyrite and other sulfur compounds in the raw materials, such as bauxite and limestone, and in fuels, such as coal and fuel oil employed during sintering, causing higher soda losses during the process and giving trouble to a number of operations, for instance, the ring-formation in the rotary kilns. The addition of anthracite, as a reducing agent to the raw mix for the kiln-feed, will reduce most of the sulfate into ferrous sulfide, which would eventually be removed from the process with red mud. This method has been successfully employed in alumina plants of soda-lime sintering process and Bayer sintering combination process

[Continuation of JINSHU XUEBAO Vol 15 No 3, Sep 79 pp 299-304]

in China since 1961. Plant operating results as well as experimental data, together with a brief discussion, are presented.



AUTHOR: LIU Baochen [0491 1405 3819]

ORG: Changsha Institute of Mining and Metallurgy Research

TITLE: "On the Action of Shotcrete Support"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 305-318

TEXT OF ENGLISH ABSTRACT: The method of shotcrete for roadway and shaft support has been developed in no fewer than 50 underground metal mines in China, but so far a theoretical analysis is lacking.

Since the deformation on the support and that on the contact plane of the rock mass are identical, and at the same time taking into account the reaction of the rock mass on support, the correlation of stress-strain and displacement of rock mass in the roadway and shaft of a circular cross section under conditions of the plane strain varying with time may be viewed on a rheological model of rock mass. Hence, the corresponding expression for the distribution of stress and strain over the rock mass and the equation for calculating stress-strain and displacement of shotcrete support are worked out. The formulae of thickness and strength in various designs required for shotcrete thus obtained are reliable for engineering practice.

AUTHOR: LI Yuewu [2621 6460 0710]  
CHEN Dong [7115 2639]

ORG: Both of Shenyang Designing Institute of Aluminum and Magnesium Industry

TITLE: "Beneficiation of Diaspore-Kaolinite-Bearing Bauxite by Flotation"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 319-322

TEXT OF ENGLISH ABSTRACT: Results of the beneficiation of the diaspore-kaolinite-bearing bauxite by flotation from laboratory and small-scale continuous processing to pilot plant testing are described. Using raw materials with initial  $Al_2O_3/SiO_2$  ratio of 4.6-5, the flotation concentrates finally attained a ratio greater than 8 with a recovery of  $Al_2O_3$  amounting to 70-80 percent.

Results of the digesting test for producing alumina by the Bayer process, as well as tests for making comprehensive utilization of the flotation tailings, are also presented.



AUTHOR: GAO Peiyu [7559 0160 6877]

ORG: Beijing Institute of Iron and Steel Technology

TITLE: "Effect of Hydrogen on the Martensitic Transformation in a 18-8 Austenitic Stainless Steel"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 323-328

TEXT OF ENGLISH ABSTRACT: Martensitic transformation of a 18-8 austenitic stainless steel cathodically charged of hydrogen has been investigated by means of optical microscopy, scanning electron microscopy and X-ray analysis. It is shown that hydrogen promotes the transformation of martensite and the  $\alpha'$ -martensite is formed next to the  $\delta$ -martensite, accompanied by the formation of surface microcracks. The effect of hydrogen on crystal defects has been regarded as responsible for the aforementioned phenomena in such steels.

AUTHOR: XU Zuyao [1777 4371 5069]

ORG: Shanghai Jiaotong University

TITLE: "A Thermodynamical Study on Martensite Transformation in Fe-C Alloys"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 329-338

TEXT OF ENGLISH ABSTRACT: An approach to further investigation of the recent understanding on martensite transformation has been developed after reviewing the relevant previous works. In particular, the physical meaning of the following formula has been clarified:

$$\Delta G^{\gamma \rightarrow M} = \Delta G^{\gamma \rightarrow \alpha} + \Delta G^{\alpha \rightarrow M}.$$

The concept of estimating and the means of calculating  $\Delta G^{\alpha \rightarrow M}$  have been dealt with, and the method for treatment has been refined. Calculation of  $\Delta G^{\gamma \rightarrow \alpha}$  has been made with certain newer data. The theoretical  $M_s$  value given by direct thermodynamical treatment agreed fairly well with that obtained by typical experiments. It is shown that the  $M_s$  of pure iron is 800 K, and a linear relationship exists between  $M_s$  on the one hand, and the carbon concentration of the alloy or the yield strength of austenite at  $M_s$  on the other. The driving force

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of phase transformation increases with the increase of carbon concentration and with the decrease of  $M_s$ .

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TITLE: "Effect of Silicon on the Transition of Brittleness in a Nickel Base Wrought Superalloy"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 339-350

TEXT OF ENGLISH ABSTRACT: The tensile strength, ductility or impact value of a wrought nickel base superalloy Ni-15Cr-6W-3Mo-2Al-2Ti depends markedly upon the silicon content of the alloy. In plotting these mechanical properties vs the silicon content, which ranges from 0.1 to 0.89 percent, a saddle shown by the existence of a minimum at about 0.4-0.6 percent Si occurs. There is reason to believe that such a saddle behavior may be caused by the variation of mechanical properties with the type, amount and morphology of carbides as well as

with the sequence of carbide precipitation in the alloy as influenced by its silicon content. Thus, the amount of  $M_6C$  and  $M_{23}C_6$  precipitated along the grain boundaries would appear to proceed in four stages as follows:

1. For silicon content up to 0.1 percent, globular  $M_{23}C_6$  may be the sole type of carbide formed;
2. In the range from 0.1 to 0.4 percent Si, besides  $M_{23}C_6$ ,  $M_6C$  begins to appear and increases with the increase of silicon content. The morphology of the carbides seems to be different, however, being in a discontinuous, blocky form;
3. In the range from 0.4 to 0.6 percent Si, continuous films of  $M_6C$  were present. As might be expected, this type of carbide is very detrimental to the tensile and impact properties at room temperature. The precipitation of  $M_{23}C_6$  was slowed down or even suppressed;
4. In the range from 0.6 to 0.89 percent Si,  $M_6C$  may be altered to discontinuous, blocky form, whereas  $M_{23}C_6$  may be very much limited.

In conclusion, the detrimental effect of carbide is mainly associated with its film-like morphology, especially along the grain boundaries. Of course, carbides in granular form are good strengtheners.

According to the prevailing view, criterion for the formation of either  $M_6C$  or

$M_{23}C_6$  in nickel base superalloys would seem to be the relative Mo and W contents, e.g., if  $Mo + 1/2 W > 6\%$ ,  $M_6C$  will be formed. The present work indicates that silicon plays an equally important role in the formation of  $M_6C$  in addition to the Mo and W contents of the wrought nickel base superalloys.

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TITLE: "Correlation Between Structure and Magnetic Properties of Amorphous Gd-Co Films"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15  
No 3, Sep 79 pp 351-358

TEXT OF ENGLISH ABSTRACT: The structure of amorphous Gd-Co films 400-700 Å in thickness has been studied by electron diffraction and results of the radial distribution functions (RDF) have been obtained for five samples. In comparing the RDF for two of the samples with perpendicular and in-plane anisotropy respectively, it is shown that a correlation between the nearest neighbor coordination of different kinds of atoms in the amorphous Gd-Co films and its magnetic anisotropy may be established.

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TITLE: "Crystallization Process and Domain Structure of Amorphous Gd-Co Thin Films"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15  
No 3, Sep 79 pp 359-361

TEXT OF ENGLISH ABSTRACT: The crystallization process of Gd<sub>17</sub>-Co<sub>83</sub> sputtered thin films has been examined by electron microscopy and electron diffraction. The samples showed a typical amorphous feature at room temperature and a crystalline state under 550°C. It was observed that the crystallization process of Gd<sub>17</sub>-Co<sub>83</sub> films underwent a change from an amorphous state through two steps of metastable phases I and II, and then into a stable state finally. The metastable phase II, however, was not a single phase, but was a mixture of several complex metastable phases. The influence of temperature on the domain structure of amorphous Gd-Co thin films has also been studied.

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TITLE: "The Stability of  $\text{SmCo}_5$  Permanent Magnet During Long-Term Aging"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 362-366

TEXT OF ENGLISH ABSTRACT: The stability of  $\text{SmCo}_5$  permanent magnet prepared by liquid phase sintering was found to depend substantially on its intrinsic coercivity and hysteresis loop squareness. A set of curves concerning initial irreversible loss, irreversible loss during long-term (up to 10,000 h) aging and total loss (including both reversible and irreversible) under certain elevated temperatures (e.g.,  $250^\circ\text{C}$ ) against  $H_{ci}$  and  $H_k$  has been plotted.

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TITLE: "An In-Situ Observation of the Microprocess of failure by Ductile Fracture in Steel"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 367-372

TEXT OF ENGLISH ABSTRACT: The microprocess of failure by ductile fracture under tensile stress in specimens of two carbon steels containing 0.15 percent and 0.45 percent C respectively and of a 25Cr20Ni-type stainless-steel has been examined in-situ in SEM. Cracking was nucleated preferentially in three different ways, e.g., at the inclusion/matrix, at the twin/matrix boundary and at the  $\sigma$ -phase/matrix interface. In both the first and second cases, the cracks were formed at the interfaces and widened in the steel matrix along the direction of applied stress. In the third case the cracks were nucleated at the

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$\sigma$ -phase/matrix interface and grew into  $\sigma$ -phase particle. As the applied stress became greater and greater, other cracks nearby appeared to coalesce along the shear direction of the steel with the result of total failure.

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TITLE: "Shell-Shaped Fracture in a Medium Carbon Steel Due to Boron Embrittlement"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 373-379

TEXT OF ENGLISH ABSTRACT: The impact fracture of a medium carbon (0.5%C) steel containing boron (0.0005-0.0050% acid soluble boron) has been examined by SEM after various heat treatments. It was found that a shell-shaped fracture occurred only if  $\text{Fe}_{23}(\text{C},\text{B})_6$  precipitated at austenite grain boundaries was in large quantities and with particle size greater than  $2\mu\text{m}$ , the corresponding impact values of such specimens being extremely low. Such specimens could not be remedied by the usual quench and temper treatment, and re-solution treatment at high temperatures (980-1050°C) followed by rapid cooling to room temperature was necessary to modify the size and distribution of the boron-containing phase, with the consequence of improving properties and eliminating the shell-shaped fracture. Similar fractures were also observed in a 40MnMoB steel.



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TITLE: "An Investigation on the Brittle Fracture of  $K_I$ - $K_{II}$  Composite Mode Cracks"

SOURCE: Shenyang, JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 380-391

TEXT OF ENGLISH ABSTRACT: The extension of the  $K_I$ - $K_{II}$  composite mode ( $K_{II}/K_I = 0-14$ ) cracks has been investigated by means of three-point and four-point bend specimens of high or medium strength steels as well as of nodular cast iron. All specimens were broken with brittle fractures under linear elastic plane strain conditions, and the extending direction of the cracks appeared to agree well with the three existing theories, e.g., the theory of maximum stress, the theory of strain energy and the theory of energy releasing rate. The crack extension resistance, however, was found to increase with the increase of the  $K_{II}$ - $K_I$  ratio, thus deviating obviously from the theoretical prediction. This finding has been investigated with regard to the following aspects, e.g., the

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configuration and size of the plastic zone, the state of stress at crack tips, etc., and, in addition, the assumption that the crack extension resistance is independent of the deformation characteristics was found to be untenable for specimens undergoing plastic deformation. Attempts have also been made to give a tentative discussion on a simple and reliable analytical method to deal with composite mode cracks for practical purposes.

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TITLE: "A Modified Double Cantilever Beam Model for Determining  $K_{IC}$ "

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 392-399

TEXT OF ENGLISH ABSTRACT: A modified model of the double cantilever beam in determining  $K_{IC}$  has been proposed. In our model the behavior of the double cantilever beam specimen is characterized by a constant stress intensity factor on the condition that cracks in the specimen propagate under constant displacement conditions. Results obtained from a 4340 steel appear to be in reasonable agreement with the established data.

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TITLE: "An Investigation of the Inhomogeneity of Mechanical Properties of a Hot-Rolled 10Ti Steel Roll"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 400-405

TEXT OF ENGLISH ABSTRACT: The yield strength of both ends of a hot-rolled 10Ti steel roll was found to be about  $10 \text{ kg/mm}^2$  higher than that of its middle. Various factors possibly contributable to such an inhomogeneity in mechanical properties have been considered and supported by experimental investigation. It is concluded that size and distribution of TiC particles are the main cause of the difference in yield strength between the ends and the middle of the roll.

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TITLE: "On the Cold Rolling Force Model and Its Adaptive Control"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15  
No 3, Sep 79 pp 406-420

TEXT OF ENGLISH ABSTRACT: The model of rolling force coefficient  $Q_p$  has been studied. Three trials of testing showed that macroscopic inhomogeneous draft may occur in the cold rolling of sheets and strips if the parameter  $l'/\bar{h}$  is less than a certain value. The coefficient  $Q_p$  given by "slab theory" does not seem proper, and should be modified by an amount of  $\Delta Q_p \propto (l'/\bar{h})^{-1}$ .

Three programs of  $Q_p$  model are suggested:

I. for different regions of the parameter  $l'/\bar{h}$

$$a) l'/\bar{h} < 4.2, Q_p = 1.7025 - 0.0402 \sqrt{\frac{R'}{H}} - 0.1972 \gamma \sqrt{\frac{R'}{H}}$$

$$l'/\bar{h} \geq 4.2, Q_p = 0.9599 + 0.0130 \sqrt{\frac{R'}{H}} + 0.0254 \gamma \sqrt{\frac{R'}{H}}$$

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$$b) Q_p = 1.08 + 1.79 \mu \gamma \sqrt{\frac{R'}{H}} - 1.02 \gamma$$

$$l'/\bar{h} < 4.2, \mu = 0.0917 + 10.6017/(l')^2$$

$$l'/\bar{h} \geq 4.2, \mu = 0.1059 - 0.0005l'$$

II. taking into account both homogeneous and inhomogeneous deformation

$$Q_p = 0.6859 - 0.4962 \gamma + 0.0099 \sqrt{\frac{R'}{H}} + 0.1025 \gamma \sqrt{\frac{R'}{H}} + 1.298 \frac{\bar{h}}{l'}$$

$$\text{or } Q_p = 0.6903 - 0.5025 \gamma + 0.0572 \frac{l'}{\bar{h}} + 0.0186 \gamma \frac{l'}{\bar{h}} + 1.29 \frac{\bar{h}}{l'}$$

III. taking into account the output elastic recovery contributing to roll force

$$a) Q_p^* = 0.4364 - 0.1350 \gamma + 0.0229 \sqrt{\frac{R'}{H}} + 0.0868 \gamma \sqrt{\frac{R'}{H}} + 1.5 \frac{\bar{h}}{l'}$$

$$b) Q_p^* = 1.08 + 1.79 \mu^* \gamma \sqrt{\frac{R'}{H}} - 1.02 \gamma$$

where

$$\mu^* = \frac{0.0356}{\frac{1}{h} - 2.503} + 0.0559$$

The parameter  $Q\beta$  seems to be more suitable for the mill of most products but the relevant computation is more complicated.

The physical idea of the equations in program II is explicit and the roll force thus estimated has been found to agree very closely with the experimental data. It is recommended for the rolling of either cold or hot strips as well as heavy plates.

From the results of off-line simulation, however, the accuracy of the model may be substantially improved by the combination of the adaptive control to latter passes of a coil with that of the same pass of the next coil using the program of the exponential smoothing method, the error being reduced to within 10 percent.

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TITLE: "The Error Caused by the Side Declining Angle of the Counter Scanning Plane and Its Effect on the X-Ray Stress Measurement"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15 No 3, Sep 79 pp 421-432

TEXT OF ENGLISH ABSTRACT: The error in the X-ray stress measurement caused by the side declining angle,  $\gamma$ , of the counter scanning plane is shown to be:

$$\Delta\sigma_x = -(\sigma_r \sin^2 \gamma + r_{rr} \sin \gamma \sum D_i \sin 2\psi_i)$$

in which  $D_i = \frac{\sum \sin^2 \psi_i - n \sin^2 \bar{\psi}}{(\sum \sin^2 \psi_i)^2 - n \sum \sin^2 \bar{\psi}}$ ;  $n$  is the number of  $\psi$ . Such a result is being supported by experimental results obtained in our laboratory.

The error in stress measurements along axial direction of a cylindrical surface and certain problems encountered in the X-ray stress measurements of anomalously shaped machine parts are discussed based on the above formula.

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TITLE: "Determination of the Activity of  $\text{RE}_2\text{O}_3$  in Liquid  $\text{RE}_2\text{O}_3\text{-CaF}_2$  and  $\text{RE}_2\text{O}_3\text{-CaO-CaF}_2$  Slags"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 15  
No 3, Sep 79 pp 433-437

TEXT OF ENGLISH ABSTRACT: The activity of  $\text{RE}_2\text{O}_3$  in both liquid  $\text{RE}_2\text{O}_3\text{-CaF}_2$  and  $\text{RE}_2\text{O}_3\text{-CaO-CaF}_2$  slags at  $1600^\circ\text{C}$  has been determined by equilibrating the slag with liquid tin in a graphite crucible under one atmosphere of carbon monoxide. Pure solid  $\text{RE}_2\text{O}_3$  and pure liquid RE metals were chosen as the standard states and the equilibrium temperature was closely controlled to within  $\pm 2^\circ\text{C}$ . The activity of  $\text{RE}_2\text{O}_3$  in the reaction  $(\text{RE}_2\text{O}_3) + 3\text{C} \rightleftharpoons 2[\text{RE}]_{\text{Sn}} + 3\text{CO}\uparrow$  was found to increase with the increase of the concentration of either  $\text{RE}_2\text{O}_3$  in the  $\text{RE}_2\text{O}_3\text{-CaF}_2$  system or  $\text{RE}_2\text{O}_3$  and CaO in the  $\text{RE}_2\text{O}_3\text{-CaO-CaF}_2$  system.

9717

CSO: 4020

Semiconductors

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TITLE: "Zone-Variational Method and Its Application in the Computation of Energy Band"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 81-93

TEXT OF ENGLISH ABSTRACT: A zone-variational calculation method for the complex potential field is presented in this paper. The numerical solution of differential equations is used to calculate the wave function in the spherical symmetric zones, while the wave function is expanded in remainder zones with an appropriate basis set. Then, the total wave function and energy are obtained through variational and iterative calculation. This method is applicable to the many atom system, but this paper mainly introduces the application of the computation in band theory. The result of our calculation for Si energy band generally agrees with that of the existing experiments and theoretical calculation. Finally, it is shown that compared to other computational methods in band theory, this method is an effective and convenient one

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for computing the energy band in solids. Although it is an ab initio computational method, its computation effort is much lower. In addition, it is a versatile method and is convenient for self-consistent calculation.



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TITLE: "Anderson Transition in Silicon Inversion Layers"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 94-99

TEXT OF ENGLISH ABSTRACT: An investigation of the Anderson Transition in MOS inversion layers is given by measuring the dependence of the channel conductivity on gate voltages in the temperature range from 4.2K to 20K. It is found through the experiment that the plots  $\ln \sigma \sim 1/T$  do not generally converge as extrapolated to  $1/T = 0$ . In view of the fact that interface potential fields have not only the microscopic disorders, but also the macroscopic inhomogeneities, the inversion layers can be considered as an inhomogeneous system consisting of many small macroscopic regions with different mobility edges. The

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model of localization for a homogeneous disorder system is used to deal with these small regions. Thus, the results obtained are in agreement with the experimental data, and the treatment is also conducive to the explanation of such "anomalous" effects as the change of mobility edge with electron Fermi energy and the appearance of magnetoconductance oscillations.

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TITLE: "Effect of Components on the Ohmic Contact Resistivity of N-Type GaAs"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 100-106

TEXT OF ENGLISH ABSTRACT: The solubilities of Ga and As in the Au-Ge and Au-Ge-Ni melts with a temperature range of 450°C to 550°C have been measured by using equipment similar to that employed in the liquid phase epitaxy. It has been found that the solubility of Ga and As increases with the increasing of temperature. However, as a result of the vaporization of As, the proportion of Ga to As in the melt increases as well. Beginning from the eutectic composition, either the increase of Au concentration or the addition of Ni to the Au-Ge melt can lead to an increase of the solubility of Ga and As. The cause of increasing solubility is discussed from the thermodynamical point of view. The contact resistivity of Au-Ge and Au-Ge-Ni (or Fe, Cr, Co) system is measured and a discussion is held over this and also over the solubility measurement and calculation of thermodynamic activity. The effect of components on ohmic contact resistivity is analyzed also.

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TITLE: "Theoretical Analysis of the Hall Effect of the Junction Field Effect Transistor"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 107-120

TEXT OF ENGLISH ABSTRACT: In this paper the Hall effect of the JFET is discussed, using standard relaxation techniques. A theoretical evaluation of the Hall voltage and Hall sensitivity of the n-channel silicon devices with various geometries (W/L), impurity concentrations (N), gate voltages ( $V_{gs}$ ) and drain voltages ( $V_{ds}$ ) is made. The results show that the typical voltage Hall sensitivity is about 10 mV/V-kG, and the current-Hall sensitivity is about  $10^2$ - $10^3$  mV/mA-kG, as  $W/L \leq 1-2$ . Based on that, a JFE-Halltron with high sensitivity, high stability and low noise has been designed.

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TITLE: "A Planar Type GaAs FET"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 121-126

TEXT OF ENGLISH ABSTRACT: A new planar type GaAs MESFET structure is presented in this paper. The results of calculations and experiments for making such a device by  $O^+$ -implantation technique are described. It is shown that the planar structure has significant advantages in its microwave characteristics and manufacturing technology over the ordinary mesa type device.

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TITLE: "A Two-Layer Logic Circuit"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 127-135

TEXT OF ENGLISH ABSTRACT: The difficulties involved in converting ECL signals into TTL signals in IC circuits are discussed in this paper. The conversion of ECL signals into TTL signals is realized by a new type of flip-flop--the floating flip-flop. Furthermore, a new circuit is presented, which we call "a two-layer logic circuit." The ECL signals in the circuit propagate in an upper voltage-level layer, while the TTL signals do so in a lower voltage-level layer. The main logic functions of sequential circuits are thus completed by the conversion of TTL signals into ECL signals in a combinational circuit and those of ECL signals into TTL signals in the register. Therefore, a four-bit multifunction ALU is successfully made.

The experimental results show that the Two-Layer Logic Circuit has several

[Continuation of BANDAOTI XUEBAO No 2, 1980 pp 127-135]

advantages, such as low power consumption, the ease of interconnections and fewer components used to complete the same logic function. Therefore it is suitable for MSI and LSI.

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TITLE: "A Design of the Logic Analyzer with Rich Functions"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 136-144

TEXT OF ENGLISH ABSTRACT: This paper suggests a design of a logic analyzer with rich functions, including the ability to compare measured data with reference data. The realization of the logic design without any race-hazard and the theory of the operation of the whole system are described in detail, and the results of the research of the Model LA-781 Logic Analyzer as an experimental sample are given.

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TITLE: "A 4 mm IMPATT Diode Oscillator"

SOURCE: Beijing BANDAOTI XUEBAO [JOURNAL OF SEMICONDUCTORS] in Chinese No 2, 1980 pp 145-161

TEXT OF ENGLISH ABSTRACT: This article presents the design parameters of the 4 mm Si P<sup>+</sup>NN<sup>+</sup> type avalanche diode, the manufacture of the diode, the structure of the microwave oscillator and some considerations of its design. It gives some important electrical parameters of the extra reflective cavity stabilized IMPATT oscillator, which are theoretically estimated from an equivalent circuit. It also gives a study on the behavior of the oscillator and its noise through a series of experiments.

The experiments show that the extra cavity stabilized oscillator operates on a frequency range of 70-80 GHz with an output power of over 20 mW (maximal power--160 mW) and an efficiency of about 1-2 percent (maximal efficiency--3.8 percent). The noise behavior of the oscillator is also proved to be

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superior to a klystron 70V10 in the same band. When it has a deviation of 30 MHz from the carrier, the mean square root frequency deviation of FM noise in a bandwidth of 100 Hz is:  $\Delta f_{rms} = 2$  Hz, while for a klystron 70V10 it would be  $\Delta f_{rms} = 9$  Hz. The frequency stability of the oscillator is about  $3.6 \times 10^{-7}$ /minute,  $1.83 \times 10^{-5}$ /hour and  $5 \times 10^{-4}$ /200 hours, which is also better when compared to a klystron.

9717

CSO: 4009

## Silicates

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TITLE: "Growth of High Quality Monocrystal Sapphire by Seed-Induced Temperature Gradient Technique (STGT)"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY] in Chinese Vol 8 No 2, 1980 pp 109-113

TEXT OF ENGLISH ABSTRACT: The various techniques for sapphire growth are summarily reviewed in this paper. It is emphasized that the melt convection in a crucible has a serious effect on the quality of Czochralski crystals; moreover, the STGT of monocrystal sapphire is proposed.

[Continuation of GUI SUANYAN XUEBAO Vol 8 No 2, 1980 pp 109-113]

The results show that the qualities of STGT crystals, such as dislocation density, optical uniformity, stress and scattering centers, etc., are better than those of the crystals grown by Verneuil and Czochralski techniques. The advantages and disadvantages of STGT for the growth of large sapphire crystals with high qualities are also discussed.



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TITLE: "Estimation of Transient Growth Rate of GGG Crystals"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]  
in Chinese Vol 8 No 2, 1980 pp 114-120

TEXT OF ENGLISH ABSTRACT: The experimental procedure in the Czochralski growth of high quality GGG single crystals is described. Growth experiments related to the coupling effect of thermal and forced convection in the melt were carried out. Attention had been paid to the inversion of solid-liquid interface during growth and also to the convective flow influence on crystal perfection.

In order to estimate the oscillations of transient growth rate during growth, iridium inclusions were intentionally grown into the crystal, thus the values

[Continuation of GUISUANYAN XUEBAO Vol 8 No 2, 1980 pp 114-120]

of growth rate could be obtained by an empirical relationship between the critical growth rate  $V_c$  and the trapped particle size  $l$ , viz.  $V_c = E/l^m$ . Through measurement of the linear sizes of a large amount of iridium particles, the constants of the empirical formula for growth of GGG can be found out, viz.  $E = 1.5 \times 10^2$ ,  $m = 1.08$ .

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TITLE: "Study of the Growth Habit of  $\text{LiTaO}_3$  Single Crystals"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]  
in Chinese Vol 8 No 2, 1980 pp 125-129

TEXT OF ENGLISH ABSTRACT: The growth habits of  $\text{LiTaO}_3$ , especially the distribution of growth ridges and facets on crystal surfaces, have been studied in detail. The mechanism of formation of the morphological features is discussed phenomenologically on the basis of the structure model of the unit cell and the appearance of these features explained in the light of structural symmetry of  $\text{LiTaO}_3$  crystals. The calculated results of the model coincide fairly well with the experimental data obtained.

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TITLE: "Growth and Perfection of Deuterated Doped Triglycine Sulfate (DATGS) Crystals"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]  
in Chinese Vol 8 No 2, 1980 pp 130-136

TEXT OF ENGLISH ABSTRACT: This article describes the experimental conditions of the growth of Deuterated Doped TGS (DATGS) crystals in  $\text{D}_2\text{O}$  solutions by the slow cooling method and the different types of defects in the crystal and the rule of their distribution as investigated by optical microscopy and X-ray topography. Compared with TGS crystals, the defects existing in DATGS crystals are far more distinct and depend much upon parameters of growth. An attempt has been made to establish the relationship between the perfection of crystals and their growth conditions in order to find out the optimum parameters for the growth of DATGS crystals so as to extend the range of their applications.

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TITLE: "Flux Growth Method for YAG:Nd Crystals and Located Nucleation Technique"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY] in Chinese Vol 8 No 2, 1980 pp 137-142

TEXT OF ENGLISH ABSTRACT: A new technique of located nucleation by water cooling used in the flux growth of YAG:Nd crystals is described, with optimum melt composition and cooling program given herein. The nucleated numbers have been controlled successfully and fairly good quality crystals of 200-400 g by weight have been produced steadily.

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TITLE: "A Study of the Quality of Sapphires by X-Ray Diffraction Topography"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY] in Chinese Vol 8 No 2, 1980 pp 143-146

TEXT OF ENGLISH ABSTRACT: X-ray diffraction topography has been employed in the study of defects in sapphire single crystals grown by Verneuil, Czochralski, Edge-Defined Film-Fed Growth (EFG) and Temperature Gradient Growth (TGG) techniques. In TGG crystals the triangular cross-grid dislocation lines have been noticed and the Burger's vectors thereof determined.

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TITLE: "An Investigation on the Chemical Durability of Nd-Doped Phosphate Glasses"

SOURCE: Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY] in Chinese Vol 8 No 2, 1980 pp 159-170

TEXT OF ENGLISH ABSTRACT: A new test method has been developed to determine the chemical durability of Nd-doped phosphate glasses of  $P_2O_5$ -BaO,  $P_2O_5$ - $Al_2O_3$ -BaO and  $P_2O_5$ - $Al_2O_3$ - $Li_2O$ -BaO systems in water. The effects of eight metallic oxide substitutes for BaO on the water resistance were investigated. The results obtained were discussed in light of glass structure and the polarization ability of the cations in glass. Based on the mechanism of glass corrosion, it was pointed out that the corrosion rate might be accelerated in some of the glasses tested.

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